National Congress on
Chemistry and nano-chemistry,
from research to national development

کنگره ملی
شیمی و نانو شیمی، از پژوهش تا توسعه ملی

نمایه سازی پروسدینگ مقالات برتر در پایگاه Thomson Reuters
چاپ ۳۰ مقاله برتر کنگره تحت book chapters در پایگاه Springer

محل برگزاری
۳ شهریور ۱۳۹۶

حضور و مشارکت ۵۰ دانشگاه ،انجمن و رسانه فعال علمی در بزرگترین رویداد داخلی حوزه شیمی و نانو شیمی کشور

Selected papers will be peer-reviewed as accepted book chapters from various themes in one edited volume to be published in one of our Springer Book Series

شماره مجوز ISC
۹۶۱۷۰-۶۰۳۰۱

Synthesis and coating of GO / HA composite on orthopedic implant surfaces and evaluation of corrosion resistance

Mohammad Hossein Heydari[1], Mahboobeh Mahmoodi[2]*, Amir Seifoddini[3]
[1]Department of Metallurgy and Materials Engineering, Yazd Branch, Islamic Azad University, Yazd, Iran
[2]Department of Biomedical Engineering, Yazd Branch, Islamic Azad University, Yazd, Iran
[3]Department of Mining & Metallurgical Engineering, Yazd University, Yazd, Iran

Corresponding author: m.mahmoodi@iauyazd.ac.ir*

ABSTRACT

Hydroxyapatite (HA) is one of the bioceramics that has good biocompatibility. The graphene oxide (GO) due to good biocompatibility and sustainability in various applications such as biosensors and drug delivery biotechnology is used. The aim of the study was to composite coating of GO/HA using electrophoretic deposition on tantalum. The deposition process was conducted at a constant voltage of 30 V and deposition time of 10 min. The samples were characterized via scanning electron microscopy (SEM), zeta potential, FTIR and contact angle test. The hydrophilic of Ta increased after coating with GO/HA nanocomposite. The results of corrosion test showed that the corrosion current density uncoated and coated samples were 43 μA/cm^2 and 1 μA/cm2, respectively and it indicated that GO/HA coating can act as a passive layer against corrosion. Also, in vitro studies showed that osteoblast-like cells proliferated in great numbers on the samples surface. Therefore, GO/HA composite coating can be a promising option for increasing the life time of Ta based orthopedic implants.
Keywords: Electrophoretic deposition (EPD), Tantalum, Hydroxyapatite, Graphene oxide, Biocompatibility

1. INTRODUCTION

Bioactive ceramics such as hydroxyapatite can spontaneously bond with bone and has the ability to form new bone tissue due to its chemical similarity to it [1]. The graphene oxide (GO) due to good biocompatibility properties, sustainability, and very large surface is used in various applications such as biosensors biotechnology, cellular imaging and drug delivery. In addition, GO has a scattering behavior and desirable mechanical properties [2]. Currently graphene and its derivatives as reinforcing materials for biomedical applications added to the hydroxyapatite [2-6]. Bioactive ceramic coating on metal implants effective ways to improve biocompatibility and adoption by the biological system. Various methods of surface modification such as plasma spraying [7], sol-gel [8] and electrophoretic deposition [9] for this expanded. Studies in recent decades on tantalum as biomaterials have attracted much attention. It is known that they are highly corrosion-resistant, possess high mechanical properties and the ability to form apatite layer in the simulated body fluid. The main objectives of tantalum surface modification are improving histocompatibility and repairing of bone and tooth [10, 11]. Hydroxyapatite (HA) is one of the bioceramics that has good biocompatibility. However, GO/HA composite coating on tantalum as dental implants rarely has been studied. Therefore in this study, GO/HA composite coating on the surface of tantalum by electrophoretic deposition (EPD) method and eventually was evaluated morphology and corrosion resistance and cellular responses the composite coatings.

2. MATERIAL AND METHOD

2-1 Preparation of GO / HA composite solution and coating process